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VEGETATIVE GROWTH OF CABBAGE IN RELATION TO SOWING TIME, PLANT SPACING AND NPK GROWN UNDER DIFFERENT LOCALITIES OF AZAD KASHMIR AND GILGIT-BALTISTAN

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ABSTRACT

Experiments were conducted to determine the proper sowing time, fertilizer requirement and appropriate spacing for cabbage cultivar viz. Golden Acre. Results revealed that sowing dates, plant spacing and NPK application significantly influenced various growth characteristics of cabbage. Number of leaves increased with delayed planting while head diameter decreased. Application of fertilizer increased the number of leaves per plant, diameter and weight of cabbage head. Close spacing (20x40cm) was best for higher cabbage yield.

Keywords: *Brassica oleracea*, cabbage, vegetative growth, sowing time, spacing, NPK.

INTRODUCTION

Cabbage, (*Brassica oleracea capitata* L.) is a well-known Brassica crop belonging to cole group of Cruiferea family. It is one of the prominent leafy vegetable crops used for both as salad and cooking. It is well adapted to grow in cold climates such as in Azad Kashmir and Northern Areas (Awan *et al*. 2005). It has been introduced in Azad Kashmir and Gilgit-Baltistan not too distant a past so it is very important to optimize its sowing time, planting distance and proper NPK ratio for different localities. Variation in the time of seedling emergence has a large effect on the size of individual plants and this intern greatly influences the outcome of the subsequent competition between individuals for growth resources (Shanmugnathan and Benjamin, 1993). The intensity of competition is amplified by high pant density (Stern, 1965, Salter *et al*. 1981; Benjamin, 1982). The aspect of crop growth need to be understood and considered when planting, because the time from transplanting to maturity is primarily affected by the time from transplanting to curd initiation (Wurr *et al*. 1986). Fertilizers are equally important for the development and quality of crop. Fully developed, compact and clear heads produce quality cabbage whereas; discolored, yellow stained, loose and open heads are of poor market quality. (Gill *et al*. 1984) reported that the delay in sowing from May to June reduced the average head yield. (Verbitskli *et al*. 1984) showed that increase in fertilizer dose increased the yield. While (Kobryn, 1987) observed that increase in plant spacing produced the crop of large heads. Kryuchkov and Suddenko (1991) reported that late sowing reduced the head development. Hasan *et al.* (2003) revealed that cabbage cultivation is more profitable in pre-rabi period and least profitable (actually negative profitable) in the late-rabi period.

The present studies were conducted to identify the appropriate sowing time, proper doses of NPK and suitable planting distance for cabbage crop in two different localities of Azad Kashmir and Gilgit-Baltistan.

MATERIALS AND METHODS

Seed of cabbage cultivar viz. Golden Acre were sown at Rawalakot and Gilgit situated in two different locations during May 2004. Three different experiments were conducted using same cultivar under rain fed conditions.

Experiment-1

This experiment was designed to determine a proper time of sowing for the crop. Five treatments were applied. The seed were treated with Benlate before sowing in pots. Sowing was started from 10th April and continued with a regular interval of 15 days till 9th June. Seedlings were hardened for one week and were transplanted to the field after five weeks of sowing. Transplanting was done at an interval of 15 days starting from 15th May and ending on 15th July. Plots of 1.8mx2.5m size served as experimental units. Transplanting was done in triplicate randomized complete block design with 2 rows per plot maintaining 90x50cm spacing. A basal dose of 90:60:30 (kgha^{-1}) NPK was applied at the time of sowing. Methyl parathion was applied to control the attack of cabbage butterfly at seeding stage. Rest of the cultural practices was uniformly applied to all the experimental units to minimize the experimental error. The data from five well-guarded and randomly selected plants from each experimental unit were recorded on the parameters as number of leaves per plant, head diameter and weight of head when they attained full size. The data regarding head diameter were recorded by using vernier caliper. Head weight was recorded with electronic balance. Means of five observations per plot for each trait were subjected to analysis of variance using standard method of Steel and Torrie, (1984) and mean comparison was accomplished using least significant difference (LSD) test.

Experiment-2

This experiment was carried out to determine the influence of fertilizer rates on cabbage. Different NPK (kg ha^{-1}) rates as 90:60:30, 120:90:50, 150:120:70 and

180:150:90. A non-fertilizer plot was maintained as control. The seed were treated with Benlate. Sowing was done in pots on 25th April. The seedlings were transplanted after five weeks of sowing from pots to the plots of 1.8m x 2.5m size each. Transplanting was done in a triplicated randomized complete block design with 2 rows per plot maintaining 90x50cm spacing. Methyl parathion was applied to control the attack of cabbage butterfly at seedling stage. Rest of the cultural practices was uniformly applied to all the experimental units. Data regarding number of leaves per plant, head diameter and weight of head were recorded from five randomly selected plants from each experimental unit when they attained full size. Means of five observations per plot for each trait were subjected to analysis of variance using standard method of Steel and Torrie, (1984) and mean comparison was accomplished using least significant difference (LSD) test.

Experiment-3

This experiment was conducted to study the influence of nutritional area on cabbage productivity. For this purpose five different row and planting distances (cm) as 40x20, 50x25, 60x30, 70x35 and 80x40 were applied to the genotype. The seed after being treated with Benlate were sown in pots on 25th April. Seedlings were later transplanted on 1st June in a triplicated randomized complete block design with 2 rows per plot. Fertilizer dose of 90:60:30 kg ha^{-1} NPK was applied at the time sowing. Methyl parathion was applied to control the insect attack. All other cultural practices were uniformly applied to all experimental units. The data from five randomly selected plants from each experimental unit were recorded on the parameters as number of leaves per plant, head diameter and weight of head when they attained full size. Means of five observation per plot for each trait were subjected to analysis of variance using standard method of Steel and Torrie, (1984) while mean comparison was accomplished using least significant difference (LSD) test.

RESULT AND DISCUSSIONS

Experiment-1

At both the sites maximum number of leaves were recorded when transplanting was done on May 15 (Table-1). However, at Gilgit transplanting at June 30 had similar number of leaves per plant as were recorded at May 15transplanting. At Rawalakot number of leaves per plant declined when transplanting was delayed beyond May 30 while comparative decline in this trait at Gilgit was recorded when transplanting was delayed beyond June 30. At Rawalakot larger head diameter was observed with early transplanting in these studies but at Gilgit transplanting time influenced head diameter to lesser extent. Over all head diameter was higher at Gilgit than that recorded at Rawalakot. Head weight declined gradually with delayed planting at both the sites. It was observed that head weight was more at Rawalakot than at Gilgit. These results are supported by the finding of Gill *et al*. (1984), Kryuchkov and Suddenko (1991) and Hasan *et al*. (2003).

Table-1. Mean values of different sowing dates on some vegetative traits of cabbage.

Transplanting times	No. of leaves/Plant		Head diameter		Head weight	
	Rawalakot	Gilgit	Rawalakot	Gilgit	Rawalakot	Gilgit
May 15	17.0a	13.7a	15.5a	37.7a	805.7d	408.3a
May 30	15.3b	12.0b	13.5a	37.3a	608.7c	394.7a
June 15	11.7c	12.0b	12.4b	35.5b	516.0ab	366.7a
June 30	11.3cd	12.7ab	14.0ab	34.7b	437.3a	254.0b
July 15	10.0d	10.3c	11.8b	32.7c	450.0a	193.0b

Values sharing common alphabets are non-significant

Experiment-2

Results (Table-2) indicated that the number of leaves per plant increased with the increase of fertilizer dose. At both sites in these studies the maximum number of leaves were recorded where NPK was applied at 180:150:90 kg ha^{-1}. At Gilgit application of 90:60:30 kg ha^{-1} NPK resulted as many leaves per plant as were recorded with highest dose of NPK in this experiment. Head diameter increased gradually with increase in fertilizer. These results are in agreement with the findings of Verbitskli *et al*. (1984). At Rawalakot lowest dose of fertilizer differed significantly with highest dose of 180:150:90 kg ha^{-1} NPK, and the rest of the treatments were statistically alike in term of head diameter. At Gilgit all the fertilizer doses showed non-significant results. Head weight at Rawalakot increased with each increment in fertilizer. However, at Gilgit, application of fertilizer over control enhanced head weight of cabbage while the difference among all the fertilizer rates was non-significant revealing that at this site lower fertilizer rate was as good as was higher. It is concluded that cabbage required a higher dose of fertilizer (180:150:90 kg ha-1) at Rawalakot while at Gilgit a lower dose of fertilizer (90:60:30kg ha-1) can produce same results. This difference might be due to difference in environmental conditions.

Table-2. Mean values of different doses of NPK on some vegetative traits of cabbage.

NPK Kg ha-1	No. of leaves/Plant		Head diameter		Head weight	
	Rawalakot	Gilgit	Rawalakot	Gilgit	Rawalakot	Gilgit
0-0-0	14.0e	13.3c	33.0c	33.7c	250.7e	222.0b
90-60-30	16.7d	14.7ab	39.0b	37.3a	276.7d	352.0a
120-90-50	21.0c	19.0b	42.0ab	36.0ab	378.3c	356.0a
150-120-70	25.0b	19.0b	44.0ab	36.0ab	387.0b	371.3a
180-150-90	29.0a	23.7a	46.0a	37.0a	411.3a	375.3a

Values sharing common alphabets are non significant

Experiment-3

Data (Table-3) indicated that at both the sites increasing nutritional area had significant influence on number of leaves per plant, head diameter and head weight of cabbage. However, there was no consistency in change in number of leaves per plant in response to nutritional area. Head diameter decreased as nutritional area increased at both the sites. It is indicative of the fact that the increase in spacing beyond the limits drastically affects the development of head diameter. Same trend was observed for head weight. These results are in conformity with the findings of Stern (1965), Slater *et al*. (1981) and Benjamin (1982).

Table-3. Mean values of different spacing on some vegetative traits of cabbage.

Nutritional area (cm x cm)	No. of leaves/Plant		Head diameter		Head weight	
	Rawalakot	Gilgit	Rawalakot	Gilgit	Rawalakot	Gilgit
40x20	12.1ab	11.9ab	33.6a	33.0a	391.9a	375.0a
50x25	12.8ab	12.6ab	30.6b	30.0b	277.3b	270.0b
60x30	11.5b	11.3b	23.3c	29.9c	225.9e	230.0d
70x35	12.1ab	11.9ab	21.6d	20.9d	238.9d	245.0c
80x40	14.1a	13.9a	21.1e	20.8e	244.2c	210.0e

Values sharing common alphabets are non-significant

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